IX. MYTONOLAGUS, A NEW LEPORINE GENUS FROM THE UINTA EOCENE SERIES IN UTAH

By J. J. Burke

The fossils described in the following paper were collected by field parties of the Carnegie Museum in the course of exploration of the Upper Eocene sediments of the Uinta Basin, in northeastern Utah, during the field seasons of 1925, 1932, and 1933. The bulk of the collection was taken from a locality known to the field parties as the "Myton Pocket," a small area of badlands in Uinta County located about six miles south and east of Myton, Utah. Fossil mammals were first discovered in this locality by the late O. A. Peterson in 1912, and many of the Uinta specimens described by the latter author[1] in 1919 were collected in this area. The exposures from which the material under description was taken are included in the Myton Member of the Uinta Eocene Series.

The first specimen discovered came from one of the sandstones forming the floor of the Myton Pocket, and a fruitless search was made of this and other sandstones of the region for better material. Later, however, several specimens were discovered in the alternating bands of green and dark brown shales which are characteristic of the area. Our best collections were made immediately after heavy rains, when the shale surfaces were washed clean and the small specimens stood out clearly against the shale slopes, but the collector was hampered by heavy gumbo mud which clung to his boots.

A note telling of the discovery of this material appeared in *Science* in February, 1933.[2] In this article mention is also made of the finding of a leporine specimen in the Duchesne River Oligocene Series. Since this announcement, specimens belonging to this group have also been discovered near the top of the Wagonhound Member of the Uinta

[1]Peterson, O. A., "Report upon the Material Discovered in the Upper Eocene of the Uinta Basin by Earl Douglas(s) in the Years 1908-1918 and by O. A. Peterson in 1912." Ann. Carn. Mus., Vol. XII, Art. 2, pp. 40-168, figs. 1-19, Pls. XXXIV-XLVII, 1919.

[2]Burke, J. J., "Eocene Lagomorpha." Science, N. S. Vol. 77, No. 1990, p. 191, Feb. 17, 1933.

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Eocene Series. Both the Duchesne River and the Wagonhound specimens are fragmentary, but are referred to the same genus as the Myton fossils.

The *Science* article stated that "at least three species" are represented in our collection. Discovery of new material and further comparative study convinces me, however, that it is unwise to recognize more than one species in the collection from the Myton Member. The species under description approaches the Leidy genus *Palæolagus* in its principal characters, but lacks the specialization found in the latter, and appears to deserve generic distinction from the Oligocene form.

The writer gratefully acknowledges the aid of the following institutions and individuals in this study: the late O. A. Peterson, under whose supervision the work was begun and for whom the species of *Mytonolagus* described below is named; the American Museum of Natural History and Dr. Walter Granger for the privilege of study of collections; Princeton University through Professor W. J. Sinclair, and the National Museum through Mr. C. W. Gilmore, for the loan of comparative material; Dr. Horace Elmer Wood II, Mr. Albert Wood, Mr. Harold Cook, and Mr. R. V. Witter for the loan of specimens from their private collections; and Mr. Sydney Prentice, of the Carnegie Museum, from whose drawings the illustrations for this paper were taken.

Order **DUPLICIDENTATA** Illiger

Family LEPORIDÆ Gray

Genus MYTONOLAGUS gen. nov.

Genotype: **Mytonolagus petersoni** sp. nov.

Holotype: Left maxillary with P^2-M^2. RM^3. Left ramus of mandible with P_3-M_3 in place. Fragments of right ramus of mandible and RP_3-RM_2, portion of right palatine, C. M. Cat. Vert. Foss. No. 11937.

Paratypes: Fragment of right maxillary with P^3-M^1; LP^4; fragment of left ramus of mandible containing portion of incisor, base of LP_3 and LP_4, LM_1; RP_4; fragments of proximal and distal extremities of right humerus; head of left humerus; proximal portions and fragments of shafts of right and left tibiæ, all found associated and presumably belonging to the same individual, C. M. Cat. Vert. Foss. No. 11935.

Left maxillary with P^3-M^2 and DP^4 removed to expose P^4, C. M. Cat. Vert. Foss. No. 11932.

Horizon: Myton Member (Horizon C of Peterson), Uinta Eocene Series.

Locality: Myton Pocket, Little Pleasant Valley, Uinta County, Utah, about six miles south and east of Myton, Duchesne County, Utah.

Diagnosis: Known species small, approaching *Palæolagus haydeni* Leidy in size, nearer *Palæolagus brachyodon* Matthew in general construction, but cheek teeth less hypsodont and more transverse, their protomere faces with lower gradients; molarization of premolars less advanced, molars less reduced; maxillary and ramus of mandible narrower and weaker in premolar region; external borders of superior and inferior tooth rows more angular in outline, premolars less transverse, relative to molars, than in *Palæolagus*; P^{3}-^{4} each with only one strong outer rootlet and with shallow internal groove. P^2 near M^3, P^4 near M^2 in size; M^1 the largest and most transverse of superior cheek teeth. P_3 approximating M_3 in size, M_1 and M_2 of nearly equal size and most transverse of inferior cheek teeth. Internal reëntrants of P_3 not persistent; main external reëntrant not extending more than half-way across triturating surface of crown.

Description: The maxillary of the holotype is deepest in the region of P^4. It is generally shallower than that found in *Palæolagus*, and broader in the molar region. In the vicinity of the premolars it shows a somewhat weaker construction than that seen in *Palæolagus brachyodon* Matthew, and is more compressed along the antero-external border than the maxillary of the latter species, while the zygoma does not appear to have been as strong. The position of the palatine foramina and the relation of the maxillary to the palatine bones are essentially as in *Palæolagus*.

No superior incisors were found with the type material, but C. M. No. 11940 includes an I^2 from the Myton Member of the Uinta Eocene Series which may belong with this species. It is slenderer than that found in *Palæolagus haydeni* Leidy, and more compressed transversely; the groove on the anterior face is less prominent than in the latter species.

A P^2 is preserved in but one specimen, the holotype. It is a small tooth, well worn, and shows a trilobate triturating surface. The principal lobe = paracone[3] is central, elongate longitudinally and

[3]The molar nomenclature of Osborn is applied to the premolars of the species under description without commitment to any theory of cusp homologies in these teeth.

produced anteriorly beyond the external and internal lobes. The internal lobe = protocone is the smallest of the three and separated from the central lobe anteriorly by a longitudinal valley. Postero-external to the central lobe occurs a third lobe = metacone, separated from the paracone anteriorly by a narrow valley which takes a postero-external course toward the posterior wall. P^2 may be described as having but a single root, but a strong vertical groove on the antero-external side of this root above and between the paracone and metacone lobes indicates a bi-fanged history. I find a groove similarly placed in P^2 of a specimen of *Desmatolagus gobiensis* M. & G. now in the collection of Carnegie Museum,[4] but in the latter tooth the groove is more prominent. In both cases the root shows a cross-section at the base similar to that observed by Forsyth Major in P^3 of a specimen which he refers to *Titanomys visenoviensis* H. V. Mey.[5] The metacone lobe of this tooth shows less reduction than in *Palæolagus temnodon* Douglass[6] or in *Palæolagus brachyodon* Matthew, and the paracone lobe is relatively larger than in the latter species.

The disproportion in size between P^2 and P^3 appears to be greater in *Mytonolagus petersoni* m. than that usually found in the same teeth in *Palæolagus brachyodon* Matthew. In P^3 of the holotype the paracone is crescentic, with a worn shelf internal to it and separated from it by a portion of the lunate fold which enters from the antero-external corner of the crown. Wear has obliterated all traces of the internal notch. From the worn internal shelf of this specimen, an anterior "wall" = protoloph, extends toward the external side of the crown, but does not entirely subtend the anterior horn of the paracone from the anterior face of the tooth. Postero-external to the crescentic paracone appears the metacone, a gently rounded cusp which is attenuated anteriorly into a long spur which curves around the antero-external

[4]The American Museum of Natural History, through Dr. Walter Granger, Curator of Fossil Mammals, has generously presented several specimens of *Desmatolagus* to the Carnegie Museum.

[5]Major, C. J. Forsyth, "On Fossil and Recent Lagomorpha." Trans. Linn. Soc. Lond., Ser. 2, Vol. VII, p. 448, Pl. 39, fig. 5b, 1899.

[6]Douglass did not specify the holotype of *Palæolagus temnodon* Douglass in the protograph, "Fossil Mammalia of the White River Beds of Montana," Trans. Amer. Philos. Soc., N.S., Vol. XX, pp. 250-251, 1901. Douglass' No. 43 (now C. M. No. 725a) is mentioned first in the description and in the table of measurements and is regarded as the holotype. Douglass' Nos. 44 (now C. M. 725) and 45 (now C. M. 725b) are paratypes. The last specimen (C. M. 725b) is a *Palæolagus brachyodon* Matthew.

angle of the crown. Posterior to the metacone occurs a tiny transverse enamel notch, almost isolated as an island. Internal to the metacone and its anterior spur occurs a shallow longitudinal valley, partly separating the metacone and the paracone.

The P^3 of C. M. 11935 is of a younger individual than the holotype and has not received a great deal of wear. It shows a weak internal notch, not persistent to the base of the enamel. P^3 of this specimen also shows slight development of the protoloph; practically the entire anterior face of the paracone is exposed, while the metacone spur is short. P^3 of this and of one other specimen in which the roots can be observed show but one strong external rootlet.

The P^3 of C. M. 11932 is entirely unworn; the roots of DP^3 were still in place when the specimen was found. The protoloph in this tooth extends across the anterior face of the crown, descending to the antero-external angle to meet the spur from the metacone. The latter spur is stronger than the corresponding one in the holotype. P^3 of this specimen also shows a slight notch posterior to the metacone which may correspond to that seen in a similar position in the holotype. The internal notch shows only slightly at the triturating surface, although the internal margin of the tooth rises a little higher in the anterior portion, and a slight depression may indicate a trace of a separation into anterior and posterior portions of the crown at this place.

I believe that no particular stress can be placed on the variations seen in the protoloph in P^3 of this species. The protoloph also appears to show considerable variation in *Palæolagus brachyodon* Matthew and in *Desmatolagus gobiensis* M. & G.; Walker[7] describes a condition which seems to resemble that found in C. M. 11935 as characteristic of P^3 of *Palæolagus turgidus* Cope, but in all the specimens of P^3 of *Palæolagus turgidus* Cope which I have seen, in which wear had not eliminated the pattern showing at the crown surface, I have detected only one reëntrant in this region, the antero-external.

The protoloph of P^4 of the holotype of *Mytonolagus petersoni* m. is complete, the paracone strongly crescentic and the metacone re-

[7]Walker, M. V., "Notes on North American Fossil Lagomorphs." The Ærend, Vol. II, No. 4, p. 234, 1931. Since this article was written, however, I have seen a specimen of *Palæolagus turgidus* Cope in the American Museum of Natural History, included under A. M. No. 12268 which shows the protoloph partly divided into two cusps. Such a construction might account for one of Walker's reëntrants.

duced over that seen in P^3. The internal notch is not shown on the worn P^4 of this specimen, and at the present stage of wear the anterior horn of the paracone fuses with the protoloph, damming the lunate valley; the outer portion of the latter valley takes a common exit with the longitudinal valley at the antero-external corner of the crown. A small cuspule occurs in the outlet, and a smaller cuspule on the spur-like anterior shoulder of the metacone.

As in P^3 of the same specimen, the internal notch is present in P^4 of C. M. No. 11935, but does not extend to the base of the enamel. The protoloph is also complete, as in the holotype, but the external outlet of the valleys is blocked by a cusp-like elevation of the crown in that region. Posterior to this place, the crown surface is depressed, but not to the level of the floor of the longitudinal valley, which is thus left isolated. A style-like cuspule is developed from the external shoulder of the metacone in this specimen; the notch posterior to the metacone participates in separating the cuspule from the metacone. P^4 of this specimen shows but one outer rootlet; the same condition is found in P^4 of all other specimens in which this region of the tooth can be examined. This rootlet is robust, transversely compressed and shows a faint shallow groove on its external side; the single rootlet in P^3 has already been noted. Probably in P^3 and P^4 of *Mytonolagus petersoni* m., the two outer rootlets which seem to characterize both P^3 and P^4 of the various species of *Palæolagus* have fused to form a single strong fang.

To expose P^4 of C. M. 11932 it was necessary to remove DP^4, which was still in place when the specimen was found. In general construction P^4 of this specimen resembles P^3, but the protoloph is nearly plane and although the outlet of the valleys at the antero-external corner of the crown is open nearly to the base, it is more constricted than in P^3 of the same specimen, or in P^4 of the holotype. The cuspules along the external border appear to have joined, together with the metacone, to form an external wall reminiscent of an ectoloph. The internal groove imparts more curvature to the internal margin of this tooth than it does to the same region in P^3.

The greater development of the internal groove in the premolars of *Palæolagus haydeni* Leidy as compared with that found in the corresponding teeth in this species should not, in my opinion, be taken as an indication of the rate of evolution of this character in the early *Leporidæ*. It is not only in *Palæolagus haydeni* Leidy, but also in

Palæolagus temnodon Douglass and in *Palæolagus agapetillus* Matthew (*non* Cope)[8] that we find the more transverse type of internal notch in the premolars, comparable with the incipient "Lepus pattern" of the molars. On the other hand, the internal notch in the premolars of *Palæolagus brachyodon* Matthew cannot be said to be much more pronounced than that seen in *Mytonolagus petersoni* m., and though more transverse in *Palæolagus turgidus* Cope and *Palæolagus intermedius* Matthew it does not yet appear on any of the premolars to be of the type seen in P^3 and P^4 of *Palæolagus haydeni* Leidy, where, in addition to the internal groove, an external portion of the fold cuts downward into the crown and shows in an isolated enamel island on the worn premolars, as it does in the molars. The prevalence of the shallow internal fold in the premolars of the species which compose what I term the "*turgidus* group" of *Palæolagus* including *Palæolagus brachyodon* Matthew, *Palæoloagus turgidus* Cope and *Palæolagus intermedius* Matthew, with which *Mytonolagus petersoni* m. appears to be allied, contrasts strongly with the more transverse fold seen in *Palæolagus temnodon* Douglass, *Palæolagus haydeni* Leidy and *Palæolagus agapetillus* Matthew (*non* Cope), a species association which may be termed the "*haydeni* group."[9]

Ehik[10] has seen fit to denominate various cuspules on the external borders of the crowns of the premolars of *Titanomys* in terms of the Osbornian nomenclature. In the case of *Mytonolagus petersoni* m. the variation in this region of the crown is considerable; I have observed somewhat similar variations in other duplicidentate species, notably in *Palæolagus brachyodon* Matthew and in *Desmatolagus gobiensis* M. & G. In the premolars of the species under description, these cuspules appear to be at times absent, or else joined to the extent that they are not distinguishable as distinct elements; furthermore, cuspules

[8]It should be kept in mind that Matthew was not certain that the species from the "upper levels of the White River beds" in Colorado was identical with *Palæolagus agapetillus* Cope. See Bull. Amer. Mus. Nat. Hist. Vol. XVI, Art. XXII, pp. 307-308, 1902. There is a possibility that the species described by Matthew is distinct from *Palæolagus agapetillus* Cope. Regardless of the specific status of *Palæolagus agapetillus* Cope, however, it, too, belongs in the *haydeni* group.

[9]Matthew appears to have been the first to recognize these species groups. See Bull. Amer. Mus. Nat. Hist., Vol. XIX, Art. VI, p. 218, 1903.

[10]Ehik, J., "The Right Interpretation of the Cheekteeth Tubercles of Titanomys." Ann. Mus. Nat. Hungarici, Vol. XXIII, pp. 178-186, figs. 1-5, 1926.

additional to those observed by Ehik are present in some of these teeth and further complicate the pattern. For these reasons I have not attempted to designate them by topographic terms. They appear to be cingular in derivation, and taking into account the variations which are commonly found in cingular elements, coupled with the fact that the pattern of the external side of the cheek teeth of *Mytonolagus petersoni* m. is already becoming obsolete and is affected by the degeneration of the external portion of the tooth, considerable variation in this region of the premolars cannot be regarded as unusual.

Unfortunately the external portion of M^1 of the holotype of *Mytonolagus petersoni* m. is lost, but the position of its external rootlets, which are still in place, indicates that it exceeded P^4 in transverse dimension to an extent approximating that to which P^4 exceeds P^3. A slight curvature in the enamel of the postero-internal margin indicates the very base of the internal notch.

In C. M. 11935, this tooth is complete and considerably less worn. The obliquity of the external border of this tooth contrasts strongly with the straighter outer border of P^4 of the same specimen. The protoloph sweeps outward to mark the greatest transverse extent of the crown and is separated from the paracone by a lunate valley similar to that seen in the premolars. A short valley from the postero-external side of the crown defines the concavity of the paracone and intervenes between the latter and the posterior wall of the crown, with which the paracone connects at the head of the valley. The posterior wall, external to this connection with the paracone, I consider to represent the degenerate metacone and accessory cusps.

Internal to the lunate main valley, M^1 of C. M. 11935 shows a broad shelf, worn unequally concave, the greatest depth of the concavity being in the posterior portion. The isolated outer portion of the internal fold appears as a pit in an enamel island. On the internal face of the crown, the notch persists nearly to the base of the enamel.

The M^1 of C. M. 11932 shows the same pattern seen in M^1 of the previous specimen, but is less worn and the two portions of the internal fold are not yet separated. M^1 of C. M. 11933 shows a stage of wear intermediate between the stages shown in C. M. 11935 and C. M. 11932; the pit has just been isolated from the internal fold. This tooth also appears to approach nearest the stage of wear shown in the single molar which was collected in the Swift Current Beds in

Saskatchewan and described and figured by Russel.[11] Russel regards this tooth as a probable M^2, but it compares best with M^1 of *Mytonolagus petersoni* m. The pattern in the two specimens is essentially the same; M^1 of C. M. 11933 shows a vertical extent of enamel on the external side of 0.8 mm. and a longitudinal measurement of 1.9 mm., measurements identical with those given for No. 8653 Nat. Mus. of Canada. The transverse measurement of 2.9 mm. given for the Swift Current specimen also compares well with the transverse measurement of 3.1 mm. taken from C. M. No. 11933. Russel has already noted the greater antero-posterior compression of the molar of his specimen over that found in the molar of *Palæolagus haydeni* Leidy. He also states that he has not seen the isolated enamel island and the "crescent" = lunate fold showing together on specimens of *Palæolagus*, but I have some specimens of *Palæolagus haydeni* Leidy showing the condition. However, the condition in this species is preserved for a much shorter time than in *Mytonolagus petersoni* m.

Taking into account the close resemblance which M^1 of the Swift Current specimen bears to the same molar in the Uinta species, and keeping in mind the Uinta character of the Swift Current fauna as a whole, I have little doubt that the Canadian species will prove to be a *Mytonolagus*, perhaps conspecific with *Mytonolagus petersoni* m.

Before passing on to the description of M^2 of this species it might be well to note the interpretation I give the molar structure of *Mytonolagus petersoni* m. I assume that the internal shelf of this species is cingular in origin and probably comprises elements including the protoconule, protocone and hypocone; the anterior "wall" is here considered the protoloph. Regardless of the apparent secondary growth of the internal fold, the fold appears to be connected with, and to have taken its origin at the time of the differentiation of, a hypocone; I see no strong objection to terming the antero-internal portion of the crown the protocone, and the postero-internal portion the hypocone, particularly if it is borne in mind that there may be additional elements represented in the internal shelf. Of the external cusps the metacone is considered to have degenerated, although represented in the external portion of the posterior wall of the crown, while the paracone is still a prominent cusp intervening between the protoloph

[11]Russel, L. S. and Wickenden, R. T. D., "An Upper Eocene Vertebrate Fauna from Saskatchewan." Trans. Roy. Soc. Canada, Vol. XXVII, 3rd Series, Sect. 4, pp. 60-61, Pl. 1, fig. 3, 1933.

and the posterior wall, with which it connects in M^1 of this species.

The above interpretation of the molar cusps of the earlier *Duplicidentata* contrasts with that of Ehik,[12] but appears to me more in accordance with the relationships of the various molar elements in other orders of mammals, and more in keeping with observed evolutionary trends in the cheek teeth of the group itself. It does not require the drastic reversal of topographic relationships of the various cusps which Ehik finds necessary to presuppose in support of his theory of a transverse, rather than a longitudinal arrangement of the principal cusps, with the paracone antero-internal, the hypocone postero-internal, the protocone central and the metacone external. Far from damaging the argument for the premolar analogy theory furnished by the cheek teeth of the *Duplicidentata*, my interpretation really strengthens it, for there does not appear to be any evidence that in the course of molarization of the premolars of this order the anterior horn of the crescentic cusp fuses with the main postero-external cusp, as Ehik supposes. On the other hand, I have observed in the premolars, molars and deciduous teeth of *Palæolagus haydeni* Leidy a progressive degeneration of the postero-external cusp and its accessory cuspules from anterior to posterior teeth in such a clear-cut manner that, regardless of cusp homologies in these series of teeth, I am convinced that the process is essentially the same in each series.

The M^2 of the holotype of *Mytonolagus petersoni* m. is badly worn, but still preserves details of the original pattern. It was exceeded in size by M^1, but not by P^4. As far as I am aware, in the known species of *Palæolagus*, P^4 always exceeds M^2 in size. The paracone in this tooth appears to be connected with the posterior wall. The enamel island with the pit occurs in the internal shelf and the internal notch still persists in this specimen.

The M^2 of C. M. No. 11932 is very little worn and shows nearly every detail of a newly erupted tooth. It is of particular interest because of the transverse arrangement of its paracone, which connects, not with the posterior wall, but with the isthmus connecting the anterior and posterior lobes of the crown. In consequence the posterior valley is elongate and extends farther internally than the anterior valley. A similar transverse arrangement of the paracone and principal valleys is sometimes found in *Palæolagus brachyodon*

[12]Ehik, J., "The Right Interpretation of the Cheekteeth Tubercles of Titanomys." Ann. Mus. Nat. Hungarici, Vol. XXIII, pp. 178-186, figs. 1-5, 1926.

Matthew, not only in M^2, but also in M^1; on the other hand, I have seen the more crescentic type of paracone and short valley occur in M^1 of that species, just as appears to have occurred in M^2 of the holotype of *Mytonolagus petersoni* m. The more transverse type of paracone I have not noted to occur in M^1 and M^2 of species of the *haydeni* group of *Palæolagus*, but as I have stated it is sometimes found in *Palæolagus brachyodon* Matthew and I suspect that it may occur in *Palæolagus turgidus* Cope and *Palæolagus intermedius* Matthew. The species of the *turgidus* group appear to have advanced somewhat beyond those of the *haydeni* group in the pattern of this region, and the degeneration of the metacone and accessory cusps is carried further; *Mytonolagus petersoni* m. shows alliance with the *turgidus* group in this as in other characters.

The M^2 of C. M. 11932 is of further interest in that it shows the hypocone as a fairly distinct cusp, somewhat pinched off from the posterior lobe, and nearer the base of the crown than the protocone. M^2 of C. M. 11933 is slightly more worn than the tooth last mentioned, but shows the same pattern.

The holotype of *Mytonolagus petersoni* m. is the only specimen with which M^3 was found. The tooth, which was found loose, is that of the left side and the root is single, longitudinally compressed but with a strong groove on the posterior face, partly separating it into an external and an internal portion. The outer portion probably represents one, or perhaps two, outer rootlets of the type found on M^1 and M^2. The triturating surface of this tooth shows a transverse paracone between anterior and posterior transverse valleys and a bulbous cuspule-like swelling along the postero-external border. The internal groove still persists on the posterior face of the crown, but the entire posterior lobe is much reduced. In general the tooth rather closely resembles the corresponding molar in *Palæolagus brachyodon* Matthew.

As noted under the description of P^4 of C. M. No. 11932, the latter permanent tooth was concealed by DP^4 which was removed to expose the unerupted tooth. The deciduous tooth, although worn, shows a pattern which approaches that of M^1 of the same specimen. The isolated enamel island and pit, so characteristic of the permanent molars, is shown here in the milk tooth also. The tooth showed two external rootlets.

The lower jaw of the holotype preserves all the cheek teeth and a part of the incisor. As compared with the lower jaw of *Palæolagus* *haydeni* Leidy it is somewhat lighter in construction throughout, and particularly in the inferior portion; it appears nearly as deep as that of the White River species, but is more transversely compressed in the premolar region; the internal side of the ramus is more vertical and less concave. The posterior mental foramen appears beneath P^4, in about the same situation as in *Palæolagus haydeni* Leidy. None of my specimens preserves the anterior mental foramen, the dental foramen, or the masseteric scar. The diastema, as nearly as I can determine from C. M. 11867, which still preserves considerable of the incisor, had about the same extent as in *Palæolagus haydeni* Leidy, but the course of the incisor diverges less from the plane of the ramus. The incisive swelling is less prominent and extends back under M^2, but the incisor does not reach posteriorly beyond the anterior root of the latter tooth. The cheek teeth are larger in proportion to the size of the ramus than in the White River species, and more transverse; the outline of the external border of the tooth row is irregular and more convex.

The lower incisor is more slender than that of *Palæolagus haydeni* Leidy, and does not show the tendency toward a flattened anterior face seen in the White River species.

Seen at the superior surface, P_3 of the holotype shows an outline such as I would expect to find in the much worn P_3 of *Palæolagus brachyodon* Matthew; the anterior lobe still preserves a cylindrical section, while the posterior lobe appears compressed longitudinally, and at the present stage of wear is exceeded in size by the anterior. There is not a trace of an internal reëntrant angle, unless a vague and faint incurvature of the internal margin of the crown can be interpreted as such. The external reëntrant angle extends about half-way across the worn surface of the crown. RP_3 of the holotype, which was found loose, shows the anterior and the posterior root portions conjoined.

Ironically enough, but two of my specimens, the holotype and C. M. No. 11939, preserve P_3 intact, and in both cases the tooth is much worn. However, the P_3 of *Mytonolagus petersoni* m. so closely resembles the corresponding tooth in species of the *turgidus* group of *Palæolagus* that I feel safe in predicting that the less worn tooth of this species, when found, will show a pattern similar to that seen in the species comprising the latter association.

Despite Matthew's[13] stand that *Palæolagus triplex* Cope is probably a synonym for *Palæolagus turgidus* Cope, with which I heartily concur, Walker,[14] in a recent paper gives the impression that *Palæolagus turgidus* Cope lacks internal reëntrants on P_3. This is emphatically not the case. The "trifolium-lobate crown" described by Cope[15] as characteristic of A. M. No. 5630, the type of *Palæolagus triplex* Cope, I have found to characterize all the specimens of P_3 of *Palæolagus turgidus* Cope which I have seen in which the pattern has not been obliterated by wear. Furthermore, in a specimen from the Upper Brule of the Wildcat Range of Nebraska, recently forwarded to me by Mr. R. V. Witter of Bayard, Nebraska, and which I take to be a lower jaw of *Palæolagus intermedius* Matthew, I find the pattern of P_3 to be of the same general type. I have not seen P_3 of *Palæolagus brachyodon* Matthew unworn or in the earlier stages of wear, but I anticipate finding a similar pattern in P_3 of this species.

As a matter of fact, had Walker seen a slightly worn P_3 of *Palæolagus turgidus* Cope he would have distinguished three internal reëntrants, one postero-internal, demarking the "third lobe" = hypoconulid, one median-internal marking off the trigonid from the talonid region of the crown, and one antero-internal, subdividing the anterior lobe. All these reëntrants have a short vertical extent on the crown, the median and anterior are slightly more persistent, but all are eliminated at an early stage of wear. On the external side of the crown, I have noted but one persistent reëntrant which marks off the anterior and the posterior lobes, although I suspect that some specimens may show a short postero-external reëntrant.

This is the pattern which will be found, I believe, to characterize P_3 of species of the *turgidus* group of *Palæolagus*, and the pattern showing in P_3 of young individuals of *Mytonolagus petersoni* m. will probably approach this type.

In P_3 of species of the *haydeni* group of *Palæolagus* the most evident departure from the *turgidus* type of pattern is seen on the internal

[13]Matthew, W. D., "Fossil Mammals of the Tertiary of Northeastern Colorado." Mem. Amer. Mus. Nat. Hist., Vol. I, part VII, p. 377, 1901, and "A Horned Rodent From the Colorado Miocene. With a Revision of the Mylagauli, Beavers, and Hares of the American Tertiary." Bull. Amer. Mus. Nat Hist., Vol. XVI, Art. XXII, p. 309, 1902.

[14]Walker, M. V., "Notes on North American Fossil Lagomorphs." The Ærend, Vol. II, No. 4, p. 234, 1931.

[15]Cope, E. D., Pal. Bull. 16, p. 4, 1873.

side. In *Palæolagus haydeni* Leidy the reëntrant corresponding to the median internal reëntrant seen in P_3 of *Palæolagus turgidus* Cope not only shows marked persistence, apparently lasting throughout the life of the animal, as Matthew has pointed out,[16] but also appears to differ from the same reëntrant in P_3 of the *turgidus* group in being composed of an inner and an outer portion which are separated by wear, the inner portion being represented by a vertical groove on the internal face of the crown, while the outer part cuts downward into the crown and shows as a pit in an isolated enamel island on the worn superior surface of the tooth. The familiar notch and pit representing the internal fold in the worn superior molars and premolars is the same type of structure.

On the other hand, not only is the median internal fold much less persistent in P_3 of species of the *turgidus* group in which it has been observed, but the external portion, the deep pit which shows on the worn P_3 of the *haydeni* species association, is either wanting or else but slightly developed. That it may show some slight development in some of these species might be inferred from a study of P_3 of the Upper Brule specimen which I have referred to *Palæolagus intermedius* Matthew; in this tooth there is a cone-shaped depression in the superior surface of the crown external to the internal reëntrant which may correspond to the pit in P_3 of species of the *haydeni* type.

The internal and external reëntrants marking off the "third lobe" in P_3 of *Palæolagus haydeni* Leidy are rather variable in their development, but are usually distinguishable on the unworn tooth.[17] The antero-internal reëntrant in P_3 of *Palæolagus turgidus* Cope may correspond to the anterior valley separating the principal anterior cusps in P_3 of *Palæolagus haydeni* Leidy. This valley is not always distinguishable in the latter species, however. In some specimens of *Palæolagus haydeni* Leidy an additional cuspule is found anterior to the usual two main trigonid cusps, and a few show a faint vertical groove on the external face of the anterior lobe. The latter groove

[16]Matthew, W. D., "The Fauna of the Titanotherium Beds of Montana." Bull. Amer. Mus. Nat. Hist., Vol. XIX, Art. VI, p. 217, 1903.

[17]Walker has stressed the presence of a postero-internal reëntrant in P^3 of his proposed genus *Protolagus*. See The Ærend, Vol. II, No. 4, pp. 230-232, Plate I (p. 239), 1931. I believe that variations of this character are not even of specific, let alone of generic, value. For that matter *Protolagus affinus* Walker appears very much like *Palæolagus haydeni* Leidy, judging from Walker's figures and description.

also appears on P_3 of some of Mr. Witter's specimens from the Upper Brule which I have referred to *Palæolagus agapetillus* Matthew (*non* Cope). The groove is a commoner occurrence in the Upper Brule species, though, and when found, is stronger.

The P_4 of the holotype of *Mytonolagus petersoni* m. is about a third more transverse than P_3 of the same specimen. The internal reëntrant valley is quite persistent in P_4 and in the molars of this species, and the base of it appears to be indicated in this specimen. A similar vertical extent of this fold is shown in P_4 of C. M. 11935, and in other specimens. LP_4 of C. M. 11939 shows a superior surface worn close to the base of the external fold. Internal to the main transverse fold occurs a small isolated pit, reminiscent of that seen in the worn P_3 of *Palæolagus haydeni* Leidy. RP_4 of the holotype shows two roots, arranged antero-posteriorly. The disproportion in size between M_1 and P_4 of *Mytonolagus petersoni* m. seems greater than that usually seen in species of *Palæolagus*. Although worn in the holotype, M_1 is considerably less so in C. M. No. 11935; in the last specimen the postero-internal reëntrant marking off the third lobe is still preserved. The main internal reëntrant is less persistent than in P_4. The shattered and but little worn M_1 of C. M. No. 11867 shows the hypoconulid as a prominent lobe. At this stage of wear the hypoconulid shows as a strong lobe and the postero-external reëntrant is a prominent notch. RM_1 of the holotype shows two root portions, separate below. The anterior portion shows two canals, the posterior, one.

In the holotype of *Mytonolagus petersoni* m., M_2 presents practically the same construction as M_1. These teeth accord rather closely in dimensions, both transverse and longitudinal. Grooves on the single root of RM_2 still indicate its tri-fanged origin.

I have M_3 in but one specimen, the holotype. The tooth is larger than in any of the species of *Palæolagus*, and shows a faint trace of the external reëntrant on the outer face of the crown, internal to which there shows an isolated enamel island. The tooth seems to have but one root.

The DP_3 is present in a badly shattered condition in C. M. No. 11867. In its present state it is hazardous to attempt an interpretation of its original construction. In general, it resembles the corresponding tooth in *Palæolagus haydeni* Leidy. The tooth is double-rooted.

The same specimen retains DP_4. The tooth resembles DP_4 in *Palæolagus haydeni* Leidy, and shows a prominent third lobe, together with a persistent external reëntrant. Antero-internally a notch appears on the anterior lobe of this tooth. Two roots are present as in DP_3.

The skeletal material recovered with C. M. No. 11935 indicates an animal of somewhat lighter frame than *Palæolagus haydeni* Leidy. The head of the humerus is less globular than in the latter species, but stands higher than the greater tuberosity. Distally the entepicondylar foramen and general proportions appear to be much as in *Palæolagus haydeni* Leidy, but the radial articular surface is less convex. The proximal portion of the tibia generally resembles that of *Palæolagus haydeni* Leidy. A portion of the shaft of this bone shows its fusion with the fibula.

Discussion: In the way of clues to the relationships of the *Duplicidentata* and other orders of mammals, or to the origin of the group, *Mytonolagus* shows little more than might be gained from a study of *Palæolagus.* Its chief interest lies in the fact that it gives us an Upper Eocene stage in the evolution of the order, although the latter might well have been inferred from Matthew's[18] observations on developmental trends in *Palæolagus*; most of the modifications traceable in the Oligocene genus are already foreshadowed in *Mytonolagus.* The specialization found in the present species will come as no surprise to students familiar with the Oligocene tendencies seen in the more progressive elements of the Uinta fauna.

The Uinta form finds a near ally in the Pipestone Creek species *Palæolagus brachyodon* Matthew. Its affinities as a whole are with *Palæolagus brachyodon* Matthew, *Palæolagus turgidus* Cope, and *Palæolagus intermedius* Matthew, rather than with the species of the *haydeni* assemblage. Walker's[19] proposal to separate *Palæolagus turgidus* Cope under the generic name *Megalagus* was premature, and his genus at best rests upon a rather insecure footing as he has diagnosed it. However, the species of the *turgidus* group show characters in common which seem to demand their recognition as a distinct line, and if further study demonstrates that they form a unit without close intergradations with species of the *haydeni* type, Walker's genus should be given full recognition and extended to include *Palæolagus brachyodon* Matthew and *Palæolagus intermedius* Matthew.

[18]Matthew, W. D., "Fauna of the Titanotherium Beds of Montana." Bull. Amer. Mus. Nat. Hist., Vol. XIX, Art. VI, p. 218, 1903.

[19]Walker, M. V., "Notes on North American Fossil Lagomorphs." The Ærend, Vol. II, No. 4, pp. 234-235, 1931.

Mytonolagus petersoni m. and species of the *turgidus* type of *Palæolagus* bear considerable resemblance to *Desmatolagus* from the Oligocene of Mongolia. I consider the latter an aberrant genus of the *Leporidæ,* in which family it was first placed by Matthew and Granger;[20] if it is to be regarded as an ancestral Ochotonid these North American species are close to the same category. It is true, though, that these American species also show closer similarity to *Titanomys* of the European Oligocene and Miocene than does *Palæolagus haydeni* Leidy, which Forsyth Major[21] selected for comparison with the European form. There can be no doubt that *Mytonolagus* is near the stem stock from which both the *Leporidæ* and the *Ochotonidæ* diverged, and in many respects can be taken as structurally ancestral to both families. However, a great deal of comparative study is required before any confident statements can be made as to the interrelationships of the various earlier genera which have been referred to the *Leporidæ* and to the *Ochotonidæ.*

MEASUREMENTS

Carnegie Museum No. 11937 (Holotype).

	mm.
P^2 antero-posterior (triturating surface)	1.5
P^2 transverse (external border to inner edge of triturating surface)	2.0
P^2 transverse (external border to inner alveolar margin)	2.7
P^3 antero-posterior (triturating surface)	1.9
P^3 transverse (external border to inner edge of triturating surface)	3.9
P^3 transverse (external border to inner alveolar margin)	5.0
P^4 antero-posterior (triturating surface)	1.9
P^4 transverse (external border to inner edge of triturating surface)	4.8
P^4 transverse (external border to inner alveolar margin)	6.2
M^1 antero-posterior (triturating surface)	2.1
M^1 transverse (external border to inner edge of triturating surface)	5.8*
M^1 transverse (external border to inner alveolar margin)	6.8*
M^2 antero-posterior (triturating surface)	1.9
M^2 transverse (external border to inner edge of triturating surface)	4.5
M^2 transverse (external border to inner alveolar margin)	6.3
M^3 antero-posterior (triturating surface)	1.5
M^3 transverse (external border to inner edge of triturating surface)	2.3
M^3 greatest transverse at right angles to long axis of tooth	2.7

[20]Matthew, W. D. and Granger, Walter, "Nine New Rodents from the Oliogcene of Mongolia." Amer. Mus. Novitates, No. 102, pp. 8-10, figs. 10-12, Dec. 31, 1923.

[21]Major, C. J. Forsyth, "On Fossil and Recent Lagomorpha." Trans. Linn. Soc. Lond., Ser. 2, Vol. VII, pp. 470-472, Pl. 36, fig. 36, 1899.

	mm.
Length of superior premolar series (at triturating surface)	5.8
Length of superior molar series (at triturating surface)	5.5**
Maxillary tooth row, alveolar measurement	11.5**
Inferior I, antero-posterior	2.4***
Inferior I, transverse	1.4***
P_3 antero-posterior (triturating surface)	1.9
P_3 transverse (triturating surface)	1.5
P_3 transverse (at alveolus)	1.7
P_4 antero-posterior (triturating surface)	2.0
P_4 transverse (triturating surface)	2.3
P_4 transverse (at alveolus)	2.3
M_1 antero-posterior (triturating surface)	2.3
M_1 transverse (triturating surface)	2.5
M_1 transverse (at alveolus)	2.8
M_2 antero-posterior (triturating surface)	2.4
M_2 transverse (triturating surface)	2.5
M_2 transverse (at alveolus)	2.7
M_3 antero-posterior (triturating surface)	1.9
M_3 transverse (triturating surface)	1.5
M_3 transverse (at alveolus)	1.6
Length of inferior premolar series (triturating surface)	4.1
Length of inferior premolar series (at alveoli)	4.9
Length of inferior molar series (triturating surface)	6.8
Length of inferior molar series (at alveoli)	7.4
Length mandibular tooth row (triturating surfaces)	10.4
Length mandibular tooth row (at alveolus)	12.4
Depth ramus under M_1 (to base of incisive swelling, internal measurement)	7.2
Width superior portion of ramus below M_1	4.9
Width superior portion of ramus below P_4	3.4
Width superior portion of ramus below P_3	2.7

Carnegie Museum No. 11935 (Paratype).

	mm.
P^3 antero-posterior (triturating surface)	1.7
P^3 transverse (external border to inner edge of triturating surface)	3.0
P^3 greatest transverse at right angles to long axis of tooth	3.8
P^4 antero-posterior (triturating surface)	2.0
P^4 transverse (external border to inner edge of triturating surface)	3.3
P^4 greatest transverse at right angles to long axis of tooth	4.4
M^1 antero-posterior (triturating surface)	2.1
M^1 transverse (external border to inner edge of triturating surface)	4.0
M^1 greatest transverse at right angles to long axis of tooth	5.0*
Inferior I antero-posterior	2.4***
Inferior I transverse	1.4***
P_3 antero-posterior (at alveolus)	2.5

	mm.
P_3 transverse (at alveolus)	1.5
P_4 antero-posterior (triturating surface)	2.2
P_4 transverse (triturating surface)	2.0
P_4 transverse (at alveolus)	2.6
M_1 antero-posterior (triturating surface)	2.3
M_1 transverse (triturating surface)	2.5
M_1 transverse (at alveolus)	2.8
Humerus, proximal portion, antero-posterior	5.2
Humerus, proximal portion, transverse	7.2
Humerus, at entepicondylar foramen, antero-posterior	2.4
Humerus, at capitellum, antero-posterior	3.0
Tibia, proximal portion, antero-posterior	7.6
Tibia, proximal portion, transverse	8.5
Tibia, distal portion of shaft, antero-posterior	2.4
Tibia, distal portion of shaft, transverse	3.0

Carnegie Museum No. 11932 (Paratype).

	mm.
P^3 antero-posterior (unworn crown surface)	1.6
P^3 transverse (unworn crown surface)	2.9
P^4 antero-posterior (unworn crown surface)	2.4
P^4 transverse (unworn crown surface)	2.9
M^1 antero-posterior (triturating surface)	1.9
M^1 transverse (external border to inner edge of triturating surface)	3.0
M^1 transverse (external border to inner alveolar margin)	4.8
M^2 antero-posterior (triturating surface)	1.9
M^2 transverse (external border to inner edge triturating surface)	2.5
M^2 transverse (external border to inner alveolar margin)	4.0
DP^4 antero-posterior (triturating surface)	2.2**
DP^4 transverse (external border to inner edge triturating surface)	3.0

Carnegie Museum No. 11940.

	mm.
I^2 antero-posterior	1.7
I^2 transverse	1.8
Inferior I antero-posterior	2.0
Inferior I transverse	1.6

Carnegie Museum No. 11933.

	mm.
M^1 antero-posterior (triturating surface)	1.9
M^1 transverse (external border to inner edge triturating surface)	3.1
M^1 transverse (external border to inner alveolar margin)	4.7
M^2 antero-posterior (triturating surface)	1.9
M^2 transverse (external border to inner edge triturating surface)	2.8
M^2 transverse (external border to inner alveolar margin)	3.9

Carnegie Museum No. 11867.

	mm.
Inferior I (antero-posterior)	1.6
Inferior I (transverse)	1.6
Length of diastema	8.3*
DP_3 antero-posterior (triturating surface)	2.5**
DP_4 antero-posterior (triturating surface)	2.9
DP_4 transverse (external border to inner edge triturating surface)	2.0
M_1 antero-posterior (triturating surface)	2.5
DP_3—DP_4 length at alveolus	4.4

Carnegie Museum No. 11939.

Inferior I antero-posterior	1.7
Inferior I transverse	1.7
P_3 antero-posterior (triturating surface)	1.7
P_3 transverse (triturating surface)	1.6
P_3 transverse at alveolus	1.7
P_4 antero-posterior (triturating surface)	2.3
P_4 transverse (triturating surface)	2.2
P_4 transverse at alveolus	2.7
M_2 antero-posterior (triturating surface)	2.6
M_2 transverse (triturating surface)	2.6*
M_2 transverse at alveolus	3.4
Depth of ramus under M_1 internal measurement	7.9
Width superior portion of ramus below M_1	3.6
Width superior portion of ramus below P_4	3.5
Width superior portion of ramus below P_3	3.0
Length of inferior premolar series (triturating surface)	4.2
Length of inferior premolar series (at alveoli)	4.8
Length of inferior molar series (at alveoli)	7.8*
Length of mandibular tooth row (triturating surfaces)	10.8*
Length of mandibular tooth row (at alveoli)	12.0

*Estimated.

**Approximate.

***Crushed.

EXPLANATION OF FIGURES

1. *Mytonolagus petersoni* Burke, holotype, C. M. No. 11937, lower aspect of maxillary with P^2—M^2 left, LM^1 restored in outline, LM^3 represented in outline by RM^3 reversed, $\times$ 3.
2. *Mytonolagus petersoni* Burke, holotype, C. M. No. 11937, RM^3, occlusal view, $\times$ 3.
3. *Mytonolagus petersoni* Burke, holotype, C. M. No. 11937, P_4—M_3 left, occlusal view, $\times$ 3.
4. *Mytonolagus petersoni* Burke, holotype, C. M. No. 11937, left ramus of mandible, outer surface, $\times$ 3.
5. *Mytonolagus petersoni* Burke, paratype, C. M. No. 11932, lower aspect of maxillary with P^3—M^2 left, $\times$ 3.
6. *Mytonolagus petersoni* Burke, paratype, C. M. 11932, occlusal view of LDP^4, $\times$ 3.
7. *Mytonolagus petersoni* Burke, paratype, C. M. No. 11935, left humerus, proximal portion, outer aspect, $\times$ 3.
8. *Mytonolagus petersoni* Burke, paratype, C. M. No. 11935, left humerus, distal portion, anterior aspect, $\times$ 3.
9. *Mytonolagus petersoni* Burke, paratype, C. M. No. 11935, right tibia, proximal end, $\times$ 3.
10. *Mytonolagus petersoni* Burke, paratype, C. M. No. 11935, P^3—M^1 right, occlusal view, $\times$ 3.
11. *Mytonolagus petersoni* Burke, paratype, C. M. No. 11935, P_3 (broken at alveolus) P_4 and M_1 left, slightly oblique occlusal view, $\times$ 3.
12. *Mytonolagus petersoni* Burke, C. M. No. 11940, RI^2, anterior view, $\times$ 3.
13. *Mytonolagus petersoni* Burke, C. M. No. 11940, RI^2, occlusal view, $\times$ 3.